AD-A117 144 AIR FORCE HUMAN RESOURCES LAB BROOKS AFB TX F/G 5/9
ADVANCED INSTRUCTIONAL SYSTEM: APPLICATIONS FOR THE FUTURE.(U)
JUL 82 W A NUNNS
UNCLASSIFIED AFHRL-TP-81-45 NL

END
DATE FILMED
08-82
DTIC

AFHRL-TP-81-45

12

AIR FORCE HUMAN RESOURCES LABORATORY

AD A117144

ADVANCED INSTRUCTIONAL SYSTEM: APPLICATIONS FOR THE FUTURE

By

William A. Nunns

LOGISTICS AND TECHNICAL TRAINING DIVISION
Technical Training Branch
Lowry Air Force Base, Colorado 80230

July 1982

Approved for public release; distribution unlimited.

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235

DTIC FILE COPY

82 07 21 018

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Public Affairs Office has reviewed this paper, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This paper has been reviewed and is approved for publication.

ROSS L. MORGAN, Technical Director
Logistics and Technical Training Division

DONALD C. TETMEYER, Colonel, USAF
Chief, Logistics and Technical Training Division

Unclassified

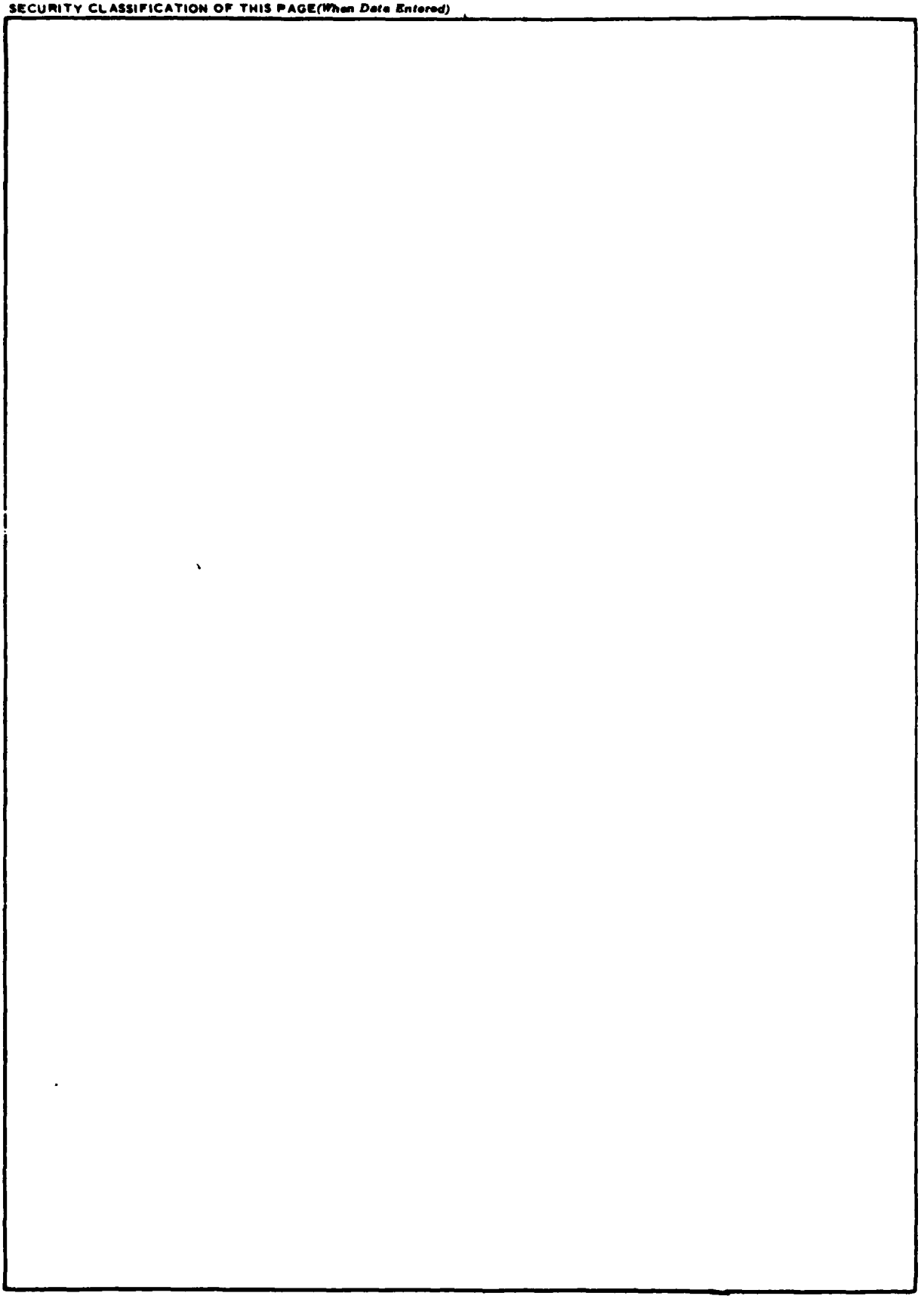
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1 REPORT NUMBER AFHRL-TP-81-45	2 GOVT ACCESSION NO.	3 RECIPIENT'S CATALOG NUMBER
4 TITLE (and Subtitle) ADVANCED INSTRUCTIONAL SYSTEM: APPLICATIONS FOR THE FUTURE		5 TYPE OF REPORT & PERIOD COVERED Technical Paper 6 PERFORMING ORG REPORT NUMBER
7 AUTHOR(s) William A. Nunns		8 CONTRACT OR GRANT NUMBER(s)
9 PERFORMING ORGANIZATION NAME AND ADDRESS Logistics and Technical Training Division Technical Training Branch Lowry Air Force Base, Colorado 80230		10 PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62205F 11210907
11 CONTROLLING OFFICE NAME AND ADDRESS HQ Air Force Human Resources Laboratory (AFSC) Brooks Air Force Base, Texas 78235		12 REPORT DATE July 1982 13 NUMBER OF PAGES 11
14 MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15 SECURITY CLASS. (of this report) Unclassified 15a DECLASSIFICATION DOWNGRADING SCHEDULE
16 DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17 DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18 SUPPLEMENTARY NOTES		
19 KEY WORDS (Continue on reverse side if necessary and identify by block number) technical training Advanced Instructional System (AIS) computer-based instruction computer-aided instruction computer-managed instruction		
20 ABSTRACT (Continue on reverse side if necessary and identify by block number) An effort by the Air Force Human Resources Laboratory (AFHRL) has demonstrated the feasibility of improving the efficiency of technical training within the Air Force through the use of a large-scale, computer-based, individualized training system called the Advanced Instructional System (AIS). This paper describes how the technology of that system is also being used to meet a wide spectrum of other training and performance support needs.		

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)



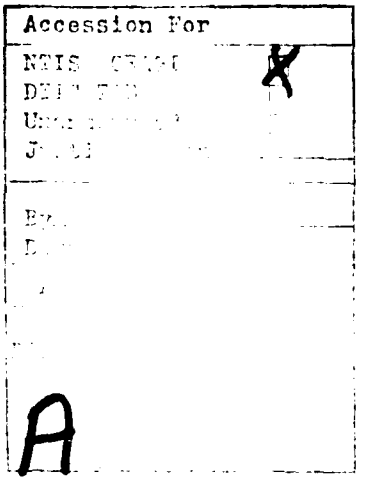
AFHRL Technical Paper 81-45

July 1982

ADVANCED INSTRUCTIONAL SYSTEM: APPLICATIONS FOR THE FUTURE

By

William A. Nunns



Reviewed and Submitted for Publication by

Allen J. Partin, LtCol, USAF
Chief, Technical Training Branch
Lowry Air Force Base, Colorado 80230

Paper Presented at the 1981 Science and Engineering Symposium, Wright-Patterson Air Force Base, Ohio, 27-29 October 1981. The symposium was co-sponsored by Air Force Systems Command and Naval Materiel Command.

SUMMARY

The Advanced Instructional System (AIS) was developed as a prototype computer-based training system to demonstrate the feasibility of administering and managing individualized instruction on a large scale. A secondary, but major, function of the AIS was to provide a research and development capability for evaluation of instructional innovations. Throughout the AIS development effort, there was a continual evolution in computer technology applicable to the instructional process. At the completion of development in 1977, the AIS incorporated state-of-the-art instructional techniques, media, and computer hardware and software.

Since completion of the formal development phase, several major capabilities have been added to the system to support other Laboratory research efforts. What has evolved is a system that, in addition to supporting the full range of computer-based instructional functions, has capabilities to support flight scheduling, information retrieval, and materials development. As a result of several technology demonstrations conducted jointly by the Air Force Human Resources Laboratory (AFHRL) and the Major Commands, the Tactical Air Command (TAC), Strategic Air Command (SAC), and Military Airlift Command (MAC) have identified applications where implementation of this technology would improve their operational effectiveness and efficiency. These implementations could well be where the full benefit of the AIS technology to the Air Force would be realized.

While the AIS instructional technology continues to be at the forefront of the state of the art, these factors prevent extensive application at this time. First, the current AIS hardware configuration has been overcome by advances in hardware technology. Second, the AIS is tied to a specific large-scale mainframe. Finally, the AIS software is written in a non-standard higher order language (HOL), CAMIL (Computer Assisted/Managed Instructional Language).

An effort is underway by AFHRL to make the instructional technology developed on the AIS available to the Air Force and to other DoD organizations by standardizing the software in a modular, minicomputer-based, Ada *language version. When this effort is completed, the AIS technology developed with Air Force R&D funds, will be* state of the art in terms of capabilities, hardware, software and can be implemented very cost effectively to meet various operational needs.

TABLE OF CONTENTS

ADVANCED INSTRUCTIONAL SYSTEM: APPLICATIONS FOR THE FUTURE

I. INTRODUCTION

An effort by the Air Force Human Resources Laboratory (AFHRL) has demonstrated the feasibility of improving the efficiency of technical training within the Air Force through the use of a large-scale, computer-based, individualized training system called the Advanced Instructional System (AIS). This paper describes how the technology of that system is also being used to meet a wide spectrum of other training and performance support needs.

II. BACKGROUND

The AIS was developed between 1973 and 1977 and has been maintained since then by McDonnell Douglas Corporation (MDC) under contract to the Air Force. For a detailed account of AIS development, see Rockway and Yasutake, 1974.[1]

During 1970 and 1971, a series of studies was initiated by AFHRL to provide a general design baseline and to explore certain critical areas prior to initiating a total system development contract. The resulting analysis and field visits illuminated some major factors faced in conducting operational training on a large scale and led to several practical considerations which influenced the design approach.

1. The system must be cost effective. It would have to demonstrate an acceptably high rate of return on investment.

2. The systems approach must apply to instructional design and to overall system development.

3. The system must be developed in such a way as to provide incremental payoff.

4. The system must have maximum modularity and flexibility to ensure both ready modification and follow-on expansion.

What evolved from these studies was a design concept for a system that would support the following program objectives:

1. Provide and demonstrate a flexible, integrated training system that utilized state-of-the-art instructional and computer technology in an individualized, self-paced, multi-media configuration.

2. Be responsive to changes in the characteristics of trainees, in technical (curricula content) requirements, and in entry and flow.

3. Provide more responsive and cost-effective training than that currently provided by conventional instructional techniques.

4. Provide a test bed for evaluating the cost and training effectiveness of proposed instructional innovations prior to Air Force-wide application.

III. AIS SYSTEM DESCRIPTION

The AIS is comprised of a series of subsystems that define its functional and operational capabilities. The instructional strategy subsystem is the key subsystem in the individualization process, with its key elements being the Student Evaluation and Adaptive Model components. The Student Evaluation component includes a preassessment testing element and a within-course testing element. The Adaptive Model makes AIS unique among other DoD and commercial Computer Assisted Instruction (CAI) and Computer Managed Instruction (CMI)

[1]Rockway, M., & Yasutake, J. The Evolution of the Air Force Advanced Instructional System. *Journal of Educational Technology Systems*, Winter 1974, **2**(3), 217–239.

systems. The Adaptive Model is the portion of the AIS software that manages the student's instructional process by minimizing contention between the order in which the student must take lessons (i.e., the best lesson treatment for the student's ability) and the types and quantities of resources required.

The AIS is a computer-based system; therefore, computer hardware and software are required to support the development, implementation, and monitoring of the strategies for instruction, resource allocation, and research requirements. The hardware and software subsystems represent areas of major continuing work due to the significant advances that have been made in hardware and software technology since the early 1970s. The results of this work are discussed in the section of this paper dealing with future developments.

The *hardware subsystem* is comprised of the mainframe, communications, and terminal components. The mainframe is a Control Data Corporation (CDC) CYBER 73-16 with 10 management terminals (each consisting of a document reader, printer, and minicomputer) for supporting CMI and with 56 interactive terminals (plasma terminals and keyboards) for supporting CAI. Subsequent to the end of the development contract, a standard RS-232 communications capability was added to the system, and standard color and black-and-white graphics are now available.

The software subsystem represents one of the major innovative aspects of the AIS, both in terms of the language used and its functional capabilities. It also represents the key component in future applications of the technology contained within AIS. This component contains all of the characteristics of a Management Information System, a real-time command and control system, and an on-line CAI system.

To support the functional capabilities, a high order language (HOL), called CAMIL (Computer Assisted Managed Instructional Language), was developed. The decision to develop CAMIL came after a thorough examination of the standard languages available in the early 1970s. The original design approach was to develop a computer language that could be used by programmers, as well as by course developers and managers with no programming skills, to implement both CAI and CMI. As the system design and development effort progressed, it became apparent that conventional approaches to developing user-oriented programming languages were not appropriate for a system such as AIS. Better ways were needed for people to *communicate with computers*.

The fundamental system design was then modified to provide a series of authoring editors for use by personnel with no programming skills. The extensive use of editors represents a major innovation in the normal approach to computer-based instructional system design. The data management editors utilize a "table-driven" approach, whereby the logic that is unique to each component of the system is represented in the form of data stored on a data base, rather than in specific program code. Normal operational changes are made by functional area specialists by changing the data bases that define their operational parameters.

CAI authoring within AIS uses a conversationally formatted editor within a structured format for CAI development. The editor structures the author's tasks to minimize authoring training by forcing set instructional strategies. The CAI editor provides for frame definition and content entry, decision logic, extensive graphics, testing (including true/false, multiple choice, and constructed response), and both feedback and prompts. CAI presentation is accomplished through the use of a general program structure and a set of support routines driven by records created by the authoring editor.

The AIS represents the foremost example of a comprehensive computer-based instructional system in which CAI is embedded within the context of CMI. Such an integrated system has distinct advantages. Student performance on CAI lessons can be recorded directly by the CMI system. Therefore, the instructor has the information and the time to assist students having unusual difficulties. More importantly, the extensive records maintained as part of CMI form an objective and complete information system that can be easily and readily accessed to allow instructional judgements to be examined in terms of their effects on student performance.

AIS in Transition. **The capabilities within AIS have continued to evolve as experience has been gained from support of technical training at Lowry AFB. Additionally, a series of technology demonstrations utilizing terminals connected to the CYBER system at Lowry have identified potential users of AIS technology. Among these was a 1-month demonstration at Luke AFB to study the feasibility of using AIS to support F-15 academic training. The demonstration was successful and led directly to an on-going program to develop an automated daily flight scheduling system for Tactical Air Command (TAC) Replacement Training Units (RTUs).**

Another AIS technology demonstration has been a 2-year pilot project to present and manage nuclear safety training at the Rocky Flats Division of Rockwell International in Boulder, Colorado. The AIS technology has addressed their training needs, and their reaction has been overwhelmingly positive.

Initial indications from a recent technology demonstration at Beale AFB showed that basic familiarization and procedural training of pilots can be accomplished effectively using the interactive CAI and graphics capabilities of the AIS. This is an area with potentially enormous payoffs—the ability to do part-task training of selected flight tasks using AIS-driven terminals. The Logistics and Technical Training Division of AFHRL at Lowry AFB is currently working with the Operations Training Division of AFHRL at Williams AFB in designing joint research efforts using the AIS technology to address operational training issues.

As a result of these demonstrations, two related and extremely significant observations were made. First, it became obvious that AIS technology had a wide application outside of the technical training environment. Second, it also became clear that while the instructional technology has wide applicability, its use is constrained by the original hardware and software implementation.

AIS Future. Because of the interest in the AIS technology expressed by a number of potential users, alternatives to the original implementation were examined that would take advantage of the latest developments in microcomputers, minicomputers, and software technologies. The objective through this process was to define a system that would perform functionally the same as AIS, be minicomputer based, modular, easily transported across various hardware systems, and be implemented in a DoD standard language. By standardizing the AIS in a more applicable form, it will be more cost effective for future users who have mission support needs that fall within the instructional/management capabilities of the AIS.

To accomplish these objectives a four-phased effort was planned to begin in early Fiscal Year 1982. This effort is designed to accomplish the following goals:

1. An analysis of the AIS to determine components to be converted, and an analysis of relevant Army and Navy systems to identify those features that should be incorporated into a coordinated DoD system.

2. An analysis of conversion techniques and languages to be used, given the current state of computer technology. (The intent is to do the standardization effort in Ada, the new DoD standard language.)

3. Actual conversion/documentation with the design approach being to standardize the AIS technology modularized by major component (i.e., CAI, CMI, GRAPHICS, INFORMATION RETRIEVAL, MATERIALS DEVELOPMENT, FLIGHT SCHEDULING, DATA REDUCTION, EDITOR DEVELOPMENT, AND TESTING) without losing the ability to integrate the system components and targeted for minicomputer and/or microcomputer implementation.

4. A full-scale operational test demonstrating both a fully integrated system and modular operational modes.

This effort is projected to take approximately 30 months, and the degree of its success is the fundamental key to how widely the AIS technology can be implemented in future operational systems.

There are several on-going and planned efforts within DoD where the AIS technology could potentially be utilized. The following paragraphs describe some of the projects in which AFHRL is working with users to implement systems that would utilize the standardized AIS.

A prototype Forward Looking Resource Scheduling System (FLRS) is being developed for TAC at Holloman AFB to assist in the generation of daily flight schedules. The scheduling system being developed is an extension of the AIS CMI resource scheduling system and, when fully implemented, will utilize the standardized software to support flight scheduling, requirements forecasting, historical data collection and analysis, reports generation, and academic management and delivery of instruction. In response to a request to install FLRS at five TAC RTU bases, the Air Force Systems Command is in the process of proposing a joint design and development effort.

As a direct result of deficiencies in training design and delivery identified in an "On-the-Job Training" Functional Management Inspection, a major research effort was initiated within AFHRL in 1979 to provide

solutions for the deficiencies. Work is currently underway on development of the Integrated Training System, which is envisioned to provide for Air Force-wide, on-the-job training management, evaluation, and delivery of instruction. The standardized AIS system is expected to provide the basic hardware/software capability to support both the development and operational versions of this system.

One of the capabilities mentioned under system standardization was information retrieval. Some specific enhancements in support of this capability were recently added to the AIS. The objective was to provide, within AIS, the capability to support an Advanced Development research effort that is developing an Automated Technical Order system. A computer-based technical data system has great potential for more efficient operation of the Air Force technical order system. In addition, a computer-based system has promise for enhancing the performance of maintenance technicians through the use of performance aiding techniques which are not available with a paper-based system.

An application of the AIS technology outside DoD recently occurred when the Canadian Forces selected MDC to support pilot and maintenance training on the CF-18. The MDC approach to training support for the Canadian Forces is functionally the same as the Air Force AIS except that implementation uses an MDC-developed cross-compiler to allow AIS CAMIL programs to run on a Digital Equipment Corporation VAX-11/780 minicomputer.

The projects just mentioned illustrate that the AIS-developed software and instructional technologies provide powerful tools for application in many diverse areas. The following paragraphs describe projects where AFHRL is working closely with developers to determine how standardized AIS could provide a viable alternative to meet their identified requirements.

The AIS technology provided the baseline for the Training and Performance Support System (TPSS), which is being developed for the Computer Systems Engineering Directorate at the Electronics Systems Division, Hanscom AFB. This system is a novel concept for linking job preparation (training) with job performance (productivity). The initial implementation of TPSS is targeted for training computer resource personnel in acquisition management skills; however, the system will have applicability to other professional-level educational and performance support scenarios. The opportunity to improve significantly the interface between the training environment and the work environment is now feasible using the TPSS model and modern computer technology.

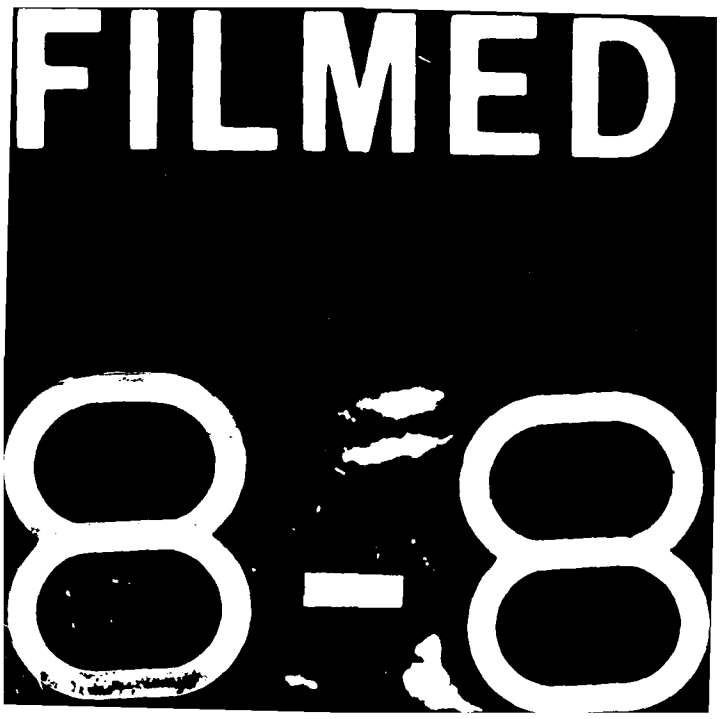
A major initiative is currently underway within the Air Training Command (ATC) to develop an Advanced Instructional Delivery and Evaluation System. The requirements for this computer-based system are defined in a Statement of Operational Need (SON) that was assigned to the Simulator System Program Office at Wright-Patterson AFB. Standardized AIS could provide all the instructional capabilities identified within the ATC SON, as well as those additional capabilities identified in the Mission Element Need Analysis developed by Military Airlift Command in support of the ATC SON.

The Instructional Systems Program Office at the Naval Weapons Center, China Lake, California, has expressed interest in the standardization of the AIS technology to minicomputers. That office is particularly interested in the CAI, CMI, and adaptive testing components of the AIS for possible inclusion in the training support systems which they developed. They have proposed that a high degree of technical liaison be established between the two Service organizations. AFHRL supports the Navy proposal and agrees that a significant potential exists for benefits to the DoD in advanced computer-based instruction technology through coordinated efforts.

Functional Management Inspections have identified a multitude of problems involving training design and delivery that are central to inadequacies in the Air Force training system. AFHRL has demonstrated technologies and is performing or planning research that addresses most of these problems. AFHRL is formulating the design of an integrated training research effort and capability using the technologies within AIS, and unconstrained by current training policy and program guidance, to expand, demonstrate, and conclusively validate the technologies that result from such research. The short-term objective is to develop empirical data on which the Air Force can make reasonable assessments of training needs and required corrective actions. The long-term objective is ultimately to increase training quality and job performance through improved training policy decisions.

IV. CONCLUSIONS

The AIS experience has shown that the manner in which institutional change is addressed can be a major determinant in how successfully advanced training technology can be implemented within given operational environments. Additionally, while a great deal of evidence exists concerning the need for and interest in applying advanced training technology to improve training effectiveness, application should follow a systems approach and be applied with judgement. The experience gained in developing and operating AIS has demonstrated that the AIS represents a significant step forward in instructional and training management technology and that the AIS technology has the potential for wide application. The AIS, and especially standardized AIS, will provide a low-cost alternative to meet future needs in resident, operational, and professional training, flight scheduling, information retrieval, materials development, and job site performance aids.


FILMED
8-8